

# Data Analysis and Probability

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# Squaring Off

- \* Dirt road
- \* Paved road
- \* 4-lane highway
- \* Yellow brick road
- \* Go to the corner that represents your place on the journey to data analysis and probability success, and discuss what you know and what you need to move to the next level.
- \* Come up with 1 to 2 burning questions for the group.

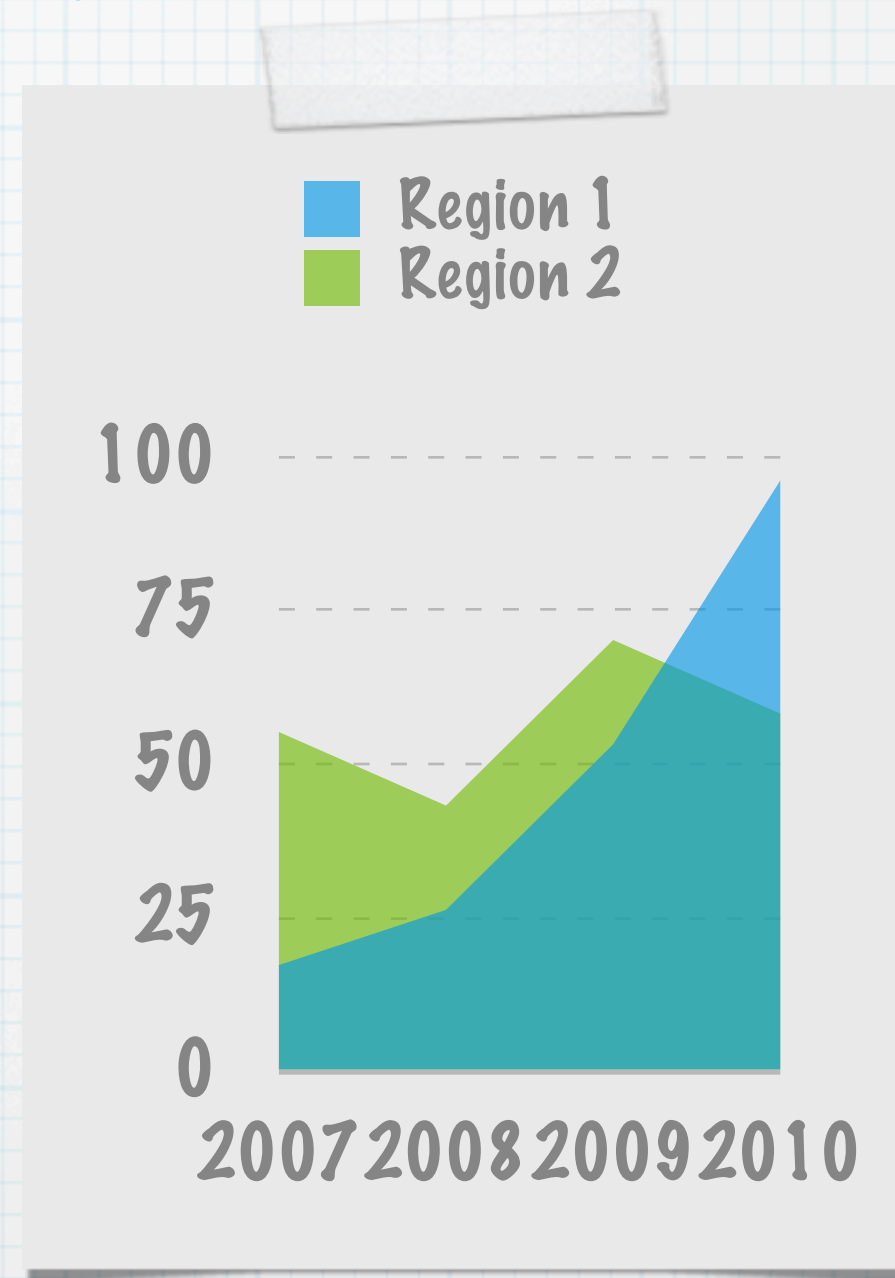


# Agenda

- \* Why data?
- \* NCTM, Illinois Standards and Assessments
- \* Collecting, Organizing and Displaying Data
- \* Question Posing and Data Analysis
- \* Probability
- \* Resources

# Why do we focus on data?

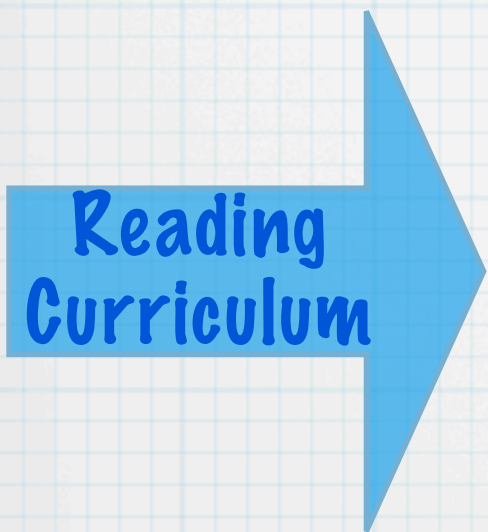
- \* Work force requests
- \* Achievement
- \* Motivation
- \* Focus
- \* Data decision making



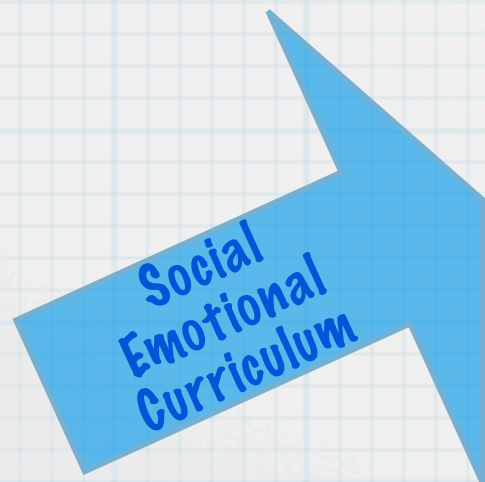
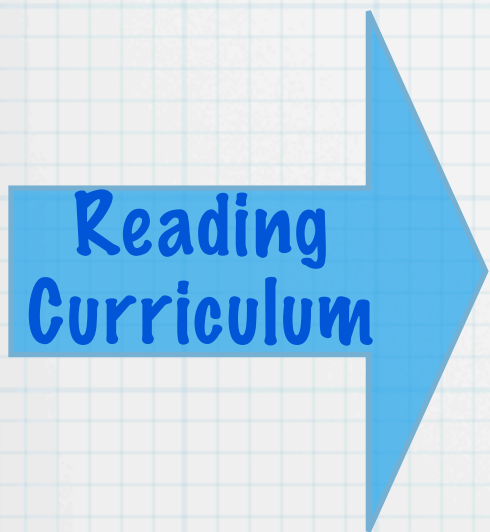


# Initiatives

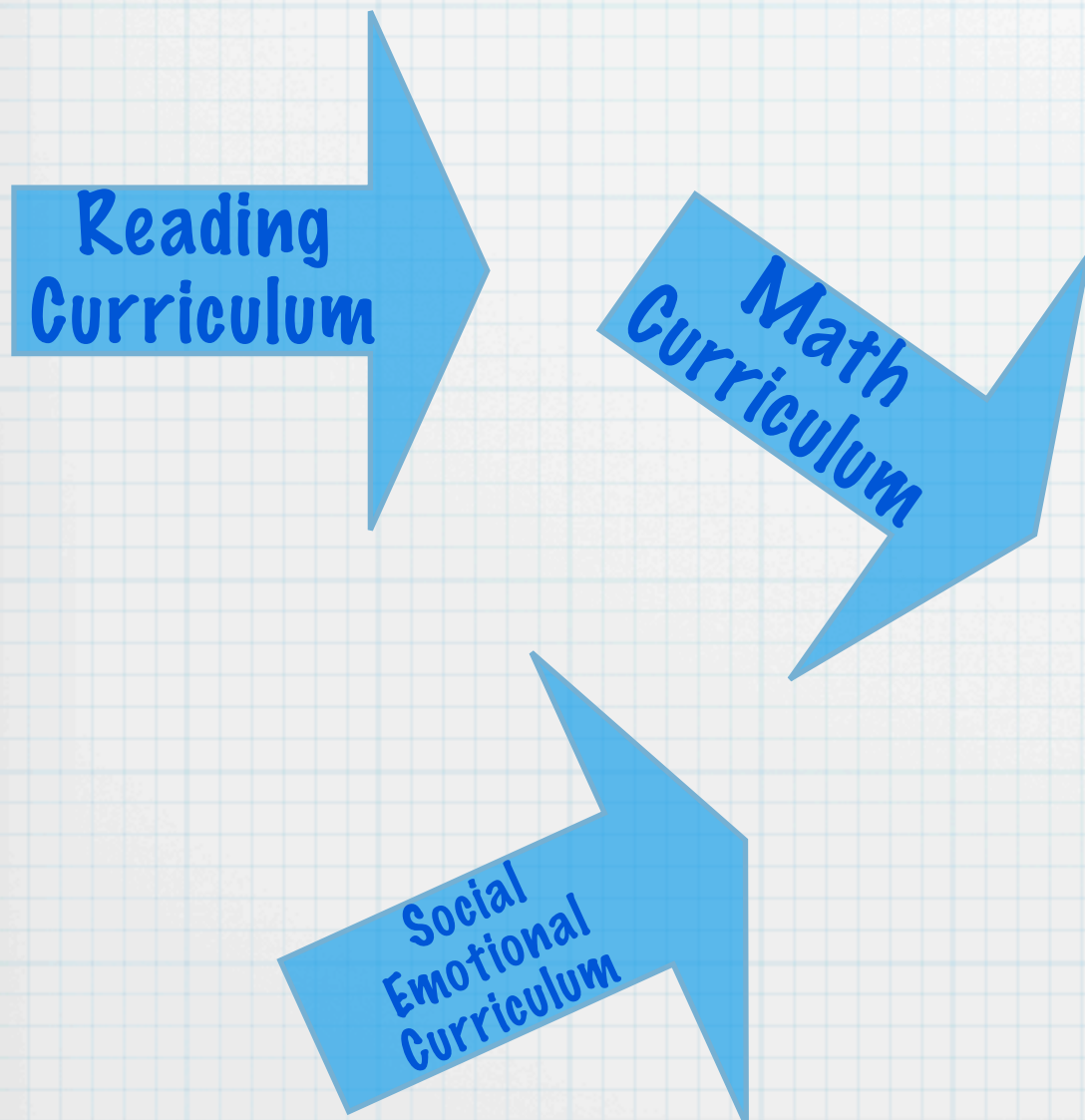
# Initiatives



# Initiatives



# Initiatives





# Initiatives

Science  
Curriculum

Reading  
Curriculum

Math  
Curriculum

Social  
Emotional  
Curriculum

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Science  
Curriculum

Reading  
Curriculum

Math  
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Social  
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Curriculum

IAA/ISAT  
Alignment

# Initiatives

Science  
Curriculum

RTI

Reading  
Curriculum

Math  
Curriculum

Social  
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IAA/ISAT  
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# Initiatives

Science  
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Data Decision  
Making

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# Initiatives

Science  
Curriculum

RTI

Data Decision  
Making

Reading  
Curriculum

Math  
Curriculum

IAA/ISAT  
Alignment

Social  
Emotional  
Curriculum

Differentiated  
Instruction

# Initiatives

Science  
Curriculum

RTI

Data Decision  
Making

Reading  
Curriculum

Math  
Curriculum

UDL

IAA/ISAT  
Alignment

Differentiated  
Instruction

Social  
Emotional  
Curriculum

# Initiatives

Science  
Curriculum

RTI

Data Decision  
Making

Reading  
Curriculum

Math  
Curriculum

UDL

Innovative  
Teaching

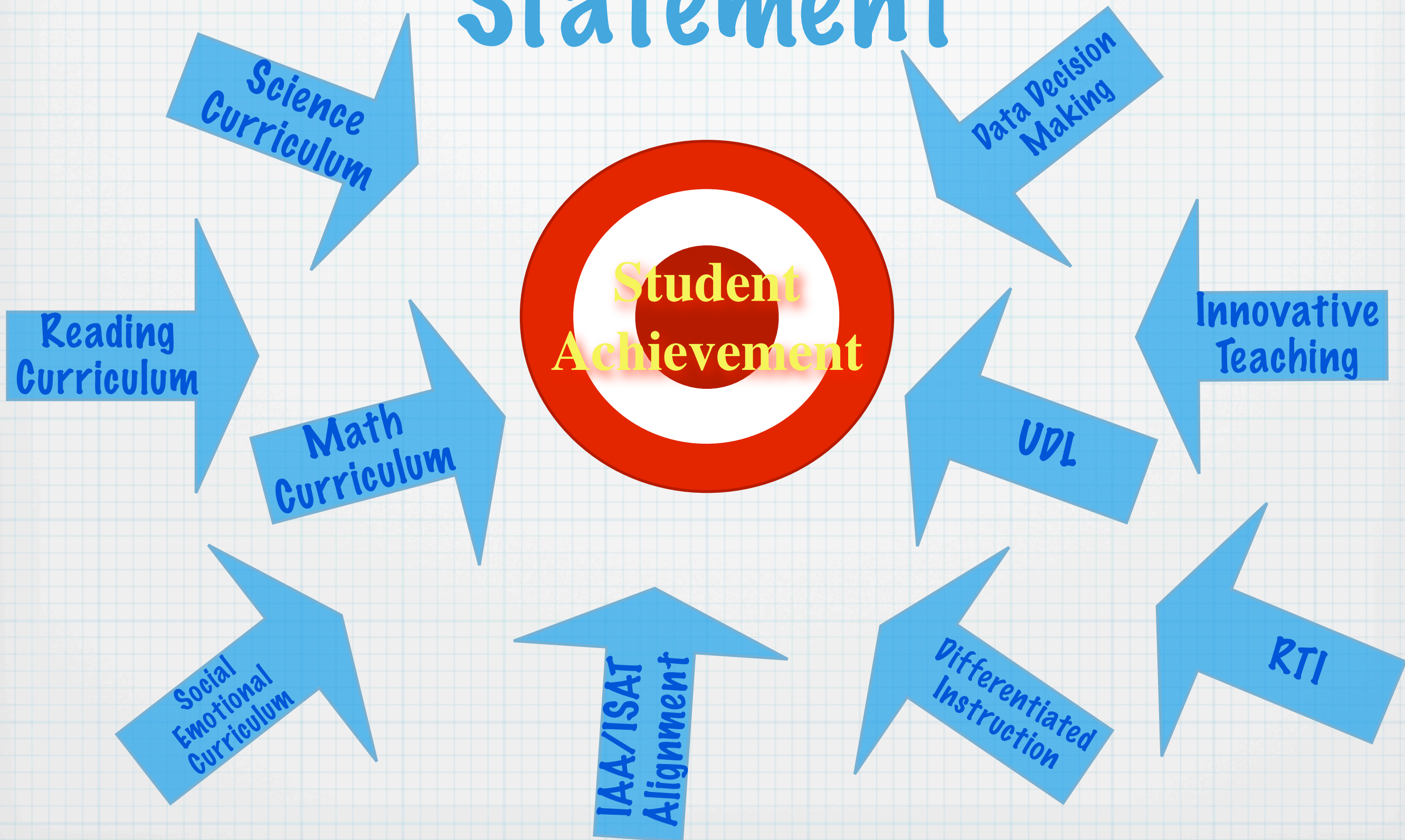
Social  
Emotional  
Curriculum

IAA/ISAT  
Alignment

Differentiated  
Instruction



# Mission/Goal Statement





# NCTM Standards

- \* Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer questions
- \* Select and use appropriate statistical methods to analyze data
- \* Develop and evaluate inferences and predictions that are based on data
- \* Understand and apply basic concepts of probability

# IL State Goal 10

- \* 10.A Organize, describe and make predictions based on data
- \* 10.B Formulate questions, design data collection methods, gather and analyze data and communication findings
- \* 10.C Determine, describe and apply probabilities to events

# IAF for ISAT

## Mathematics – State Goal 10: Data Analysis, Statistics, and Probability

|  | Grade 3  | Grade 4   | Grade 5  | Grade 6  | Grade 7   | Grade 8  |
|--|--|---|--|--|---|--|
| <b>Standards 10A, 10B – Data Analysis and Statistics</b> |  |   |  |  |   |  |
| <b>Read and Interpret Displays</b>                       | <b>Calculators Not Allowed</b><br><br><b>10.3.01</b> Read and interpret data represented in a pictograph, bar graph, Venn diagram (with two circles), tally chart, or table. | <b>Calculators Allowed</b><br><br><b>10.4.01</b> Read and interpret data represented in a pictograph, bar graph, line (dot) plot, Venn diagram (with two circles), tally chart, table, line graph, or circle graph. | <b>Calculators Allowed</b><br><br><b>10.5.01</b> Read, interpret, and make predictions from data represented in a pictograph, bar graph, line (dot) plot, Venn diagram (with two circles), chart/table, line graph, or circle graph. | <b>Calculators Allowed</b><br><br><b>10.6.01</b> Read, interpret, and make predictions from data represented in a bar graph, line (dot) plot, Venn diagram (with two circles), chart/table, line graph, or circle graph. | <b>Calculators Allowed</b><br><br><b>10.7.01</b> Read, interpret, and make predictions from data represented in a bar graph, line (dot) plot, Venn diagram (with two circles), chart/table, line graph, scatter plot, circle graph, or histogram. | <b>Calculators Allowed</b><br><br><b>10.8.01</b> Read, interpret (including possible misleading characteristics), and make predictions from data represented in a bar graph, line (dot) plot, Venn diagram (with two or three circles), chart/table, line graph, scatter plot, circle graph, stem-and-leaf plot, or histogram. |
|  |  |   |  | <b>10.6.02</b> Compare different representations of the same data.   | <b>10.7.02</b> Compare different representations of the same data.  | <b>10.8.02</b> Compare and contrast the effectiveness of different representations of the same data.   |
| <b>Complete and Create Displays</b>                      | <b>10.3.02</b> Complete missing parts of a pictograph, bar graph, tally chart, or table for a given set of data.   | <b>10.4.02</b> Create a pictograph, bar graph, tally chart, or table for a given set of data.   | <b>10.5.02</b> Create a pictograph, bar graph, chart/table, or line graph for a given set of data.   | <b>10.6.03</b> Create a bar graph, chart/table, line graph, or circle graph with common referents ( $\frac{1}{4}$ , 50%, .75) for a given set of data.   | <b>10.7.03</b> Create a bar graph, chart/table, line graph, or circle graph for a given set of data.  | <b>10.8.03</b> Create a bar graph, chart/table, line graph, or circle graph and solve a problem using the data in the graph for a given set of data.   |
| <b>Line of Best Fit</b>                                  |  |   |  |  | <b>10.7.04</b> Identify a reasonable approximation of the line of best fit from a set of data or a scatter plot.  | <b>10.8.04</b> Identify or draw a reasonable approximation of the line of best fit from a set of data or a scatter plot, and use the line to make predictions.   |
| <b>Statistics</b>  | <b>10.3.03</b> Determine the mode, given a set of data or a graph.   | <b>10.4.03</b> Determine the mode and range, given a set of data or a graph.  | <b>10.5.03</b> Determine the mode, range, median (with an odd number of data points), and mean, given a set of data or a graph.  | <b>10.6.04</b> Determine the mode, range, median, and mean, given a set of data or a graph.  | <b>10.7.05</b> Determine and use the mode, range, median, and mean to interpret data.   | <b>10.8.05</b> Analyze and apply measures of central tendency (mode, range, median, and mean) in problem-solving situations.   |



# IAF for ISAT

## Mathematics – State Goal 10: Data Analysis, Statistics, and Probability

|   | Grade 3   | Grade 4   | Grade 5  | Grade 6  | Grade 7   | Grade 8  |
|---|---|---|--|--|---|--|
| <b>Standard 10C – Probability</b>       |   |   |  |  |   |  |
| <b>Probability</b>                      | <b>Calculators Not Allowed</b>  | <b>Calculators Allowed</b>  | <b>Calculators Allowed</b>   | <b>Calculators Allowed</b>   | <b>Calculators Allowed</b>  | <b>Calculators Allowed</b>   |
|   | <b>10.3.04</b> Classify events using words such as certain, most likely, equally likely, least likely, possible, and impossible.<br><br><b>10.3.05</b> Describe the chances associated with a context presented visually, including using the response format “3 out of 4.” | <b>10.4.04</b> Classify events using words such as certain, most likely, equally likely, least likely, possible, and impossible.<br><br><b>10.4.05</b> Describe the chances associated with a context presented visually, including using the response format “3 out of 4” or $\frac{3}{4}$ . | <b>10.5.04</b> Solve problems involving the probability of a simple event, including representing the probability as a fraction between zero and one.  | <b>10.6.05</b> Solve problems involving the probability of a simple event, including representing the probability as a fraction, decimal, or percent.            | <b>10.7.06</b> Solve problems involving the probability of a simple or compound event, including representing the probability as a fraction, decimal, or percent. | <b>10.8.06</b> Solve problems involving the probability of an event composed of repeated trials, compound events (including independent events), or future events with or without replacement. |
| <b>Outcomes and Counting Principles</b> |   |   | <b>10.5.05</b> Apply the fundamental counting principle in a simple problem (e.g., How many different combinations of one-scoop ice cream cones can be made with 3 flavors and 2 types of cones?). | <b>10.6.06</b> Apply the fundamental counting principle in a simple problem (e.g., How many different 3-digit numbers can be made with the digits 1, 2, and 2?). | <b>10.7.07</b> Represent all possible outcomes for simple events.   | <b>10.8.07</b> Represent all possible outcomes (sample space) for simple or compound events (e.g., tables, grids, tree diagrams).  |
|   |   |   |  |  | <b>10.7.08</b> Solve simple problems involving the number of ways objects can be arranged (permutations and combinations).  | <b>10.8.08</b> Solve simple problems involving the number of ways objects can be arranged (permutations and combinations).   |



# IAA Frameworks Example

## Illinois Alternate Assessment Mathematics Frameworks Priorities Grade 4

| <b>State Goal 10</b>  |   |   |  |  |  |
|---|---|---|--|--|--|
| <b>Data Analysis and Statistics (Standards A and B)</b>   |   |   |  |  |  |
| <b>Read and Interpret Displays</b>  |   |   |  |  |  |
| <b>10.4.01 Read and interpret data represented in a pictograph, bar graph, line (dot) plot, Venn diagram (with two circles), tally chart, table, line graph, or circle graph.</b> |   |   |  |  |  |
| Critical Function   | Suggested General Education Activity  | Suggested Modified Instructional Activity                             | Possible Assessment Activity 1   | Possible Assessment Activity 2   | Possible Assessment Activity 3   |
| Read and interpret various graphs.  | The teacher will model how to read and interpret different types of graphs. Given various graphs with keys, the teachers will explain how to read different types of graphs. While showing and explaining the graphs the teacher will ask questions related to data in the graph. The students will answer questions related to the information contained on the graph. | Same as suggested General Education Activity with necessary supports. | Given a graph with a key, the student will answer “yes” or “no” questions about data on the graph. | Given a graph with a key, the student will answer multiple-choice questions about data on the graph. | Given a graph with a key, the student will answer questions about data on the graph. |

# How well do they align?

- \* Examine NCTM Standards, IAF for ISAT and IAA
- \* Turn to your partner to share your thoughts on the alignment of the Illinois Assessments for Goal 10

# Pre-K and K Skills

- \* Use and describe objects' attributes to identify relationships
  - \* Geometry
  - \* Measurement
    - \* e.g., size, quantity, orientation, number of vertices, color
- \* Sort to solve problems
  - \* What solids roll?
  - \* Resort (change from "What solids roll to which ones stack?")
  - \* Counting (favorite snacks)



# Primary Skills

- \* Represent data in pictures and bar graphs first
  - \* Counting
  - \* Comparing to meaningful connections to number relationships
- \* Addition, Subtraction, Multiplication and Division of whole numbers come into play
  - \* Students construct and analyze
    - \* Frequency tables, bar graphs, picture graphs, and line plots
  - \* Use to solve problems



# Intermediate Skills

- \* Addition, Subtraction, Multiplication and Division of whole numbers, fractions, and decimals
  - \* Students construct and analyze
    - \* Stem-and-leaf plots and double-bar graphs
    - \* Use all to solve problems
- \* Use ordered pairs on coordinate grid
- \* Begin to make inferences and predictions

# Junior High Skills

- \* Use proportions to make estimates relating to a populations on a the basis of a sample
- \* Apply percentages to make and interpret histograms and circle graphs
- \* Use descriptive statistics to summarize
  - \* mean, range, mode
- \* Organize data to pose and answer questions
- \* Investigate different effects that change data values
  - \* The center alone does describe a data set
  - \* Different sets can share a data center

# Collecting, Organizing and Displaying Data

- \* Building graphs
- \* Surveys
- \* Sorting - similarities and differences

“The main purpose of collecting data is to answer questions when the answers are not immediately obvious.”

Principals and Standards, p.109



# Google Docs



Create a survey



Email it to participants



Compiles it into a spreadsheet



See a summary with graphs

## Gages Lake School

Please complete the following survey so that Room 301 can write an article for our school newspaper about the staff at Gages Lake School.

Name

What level of degree do you have?

How many years of teaching experience do you have?

- ☐ 1 to 4 years
- ☐ 5 to 9 years
- ☐ 10 years to 19 years
- ☐ 20 years or more

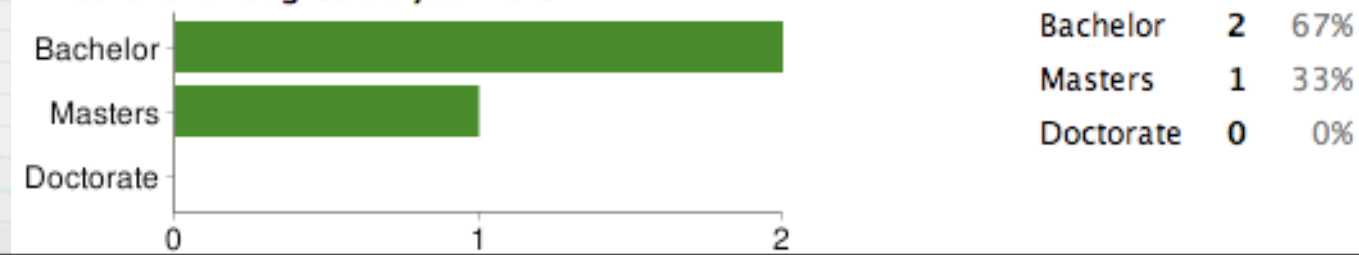
**3** [responses](#)

## Summary [See complete responses](#)

Name

Mrs. Smith, Mr. James, Mrs. Bright

What level of degree do you have?





# What data should we use?

- \* Make it as personal as possible to hook students!
- \* When you track something, it becomes important
- \* Achievement Data
- \* Attendance Data
- \* Behavioral Data

# Quick Idea

- \* Use familiar songs and rhymes:
- \* Row, Row, Row, Your Boat
- \* Teaches tally marks and gives practice with counting (one to one correspondence)



# Question Posing and Data Analysis

- \* Pose the question
- \* Collect the data
- \* Analyze the data
- \* Interpret the Results

Alan Graham, 1987



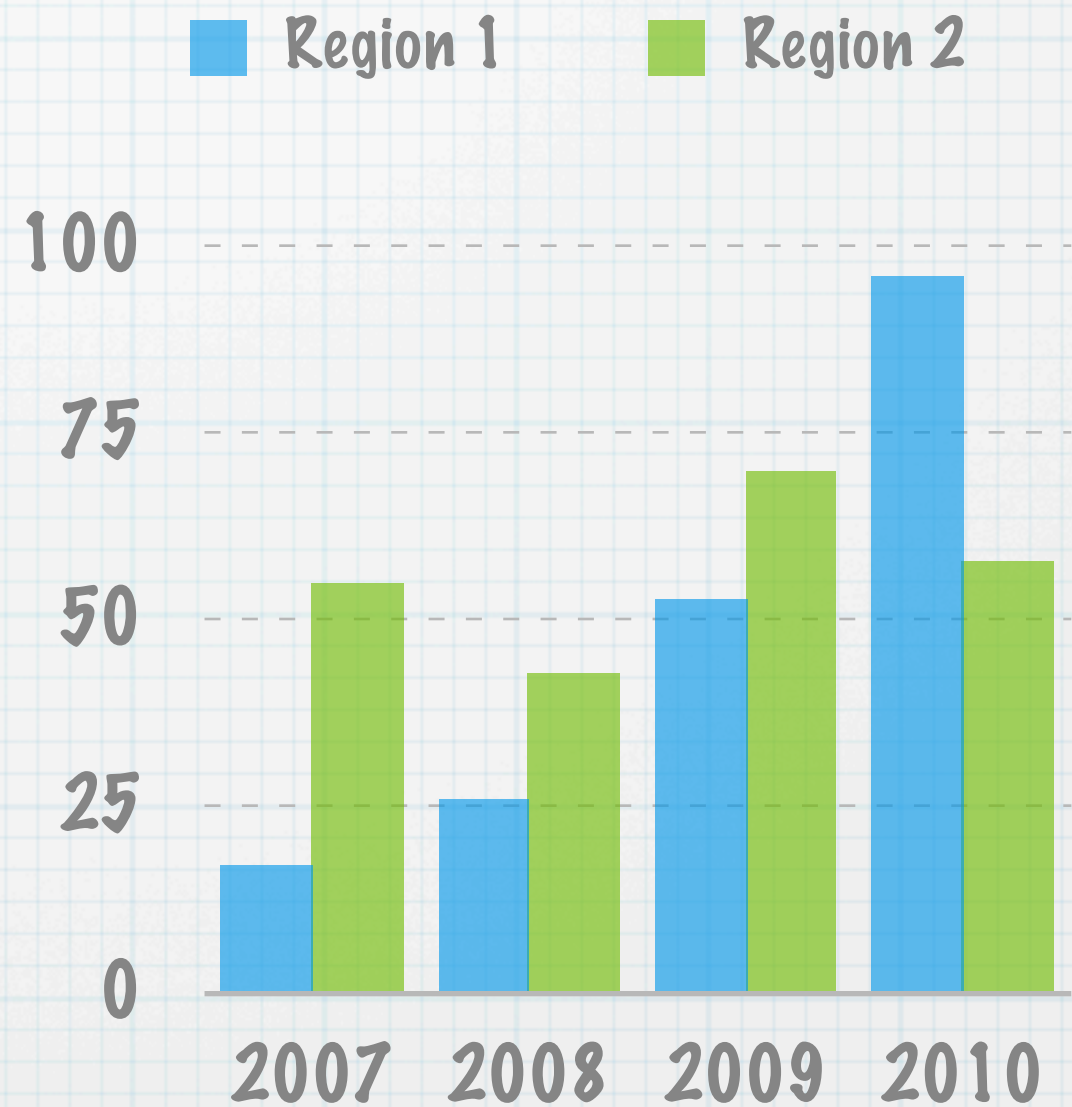
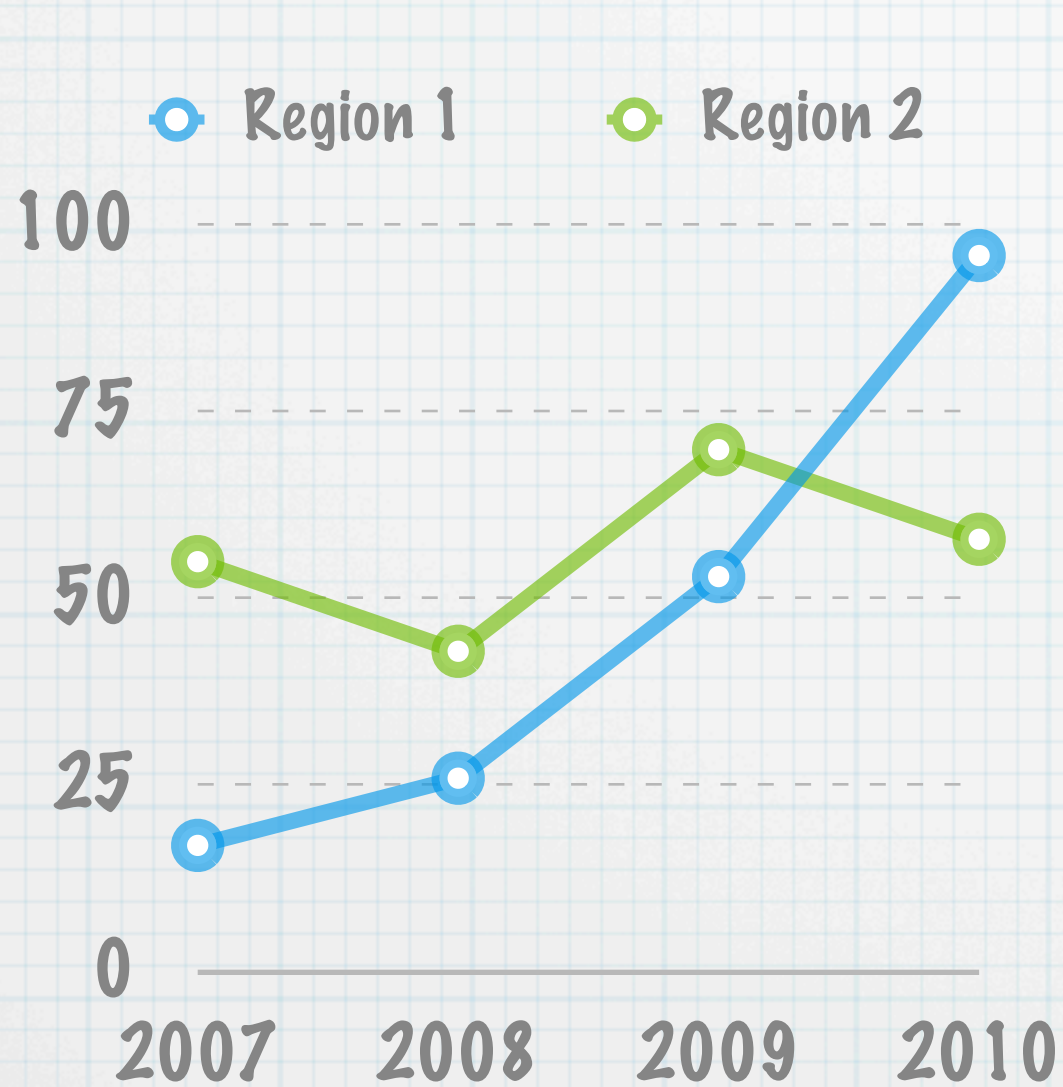
# Display data in different formats

- \* Tables
- \* Tallies
- \* Picture graphs
- \* Bar graphs
- \* Line graphs
- \* Pie Charts

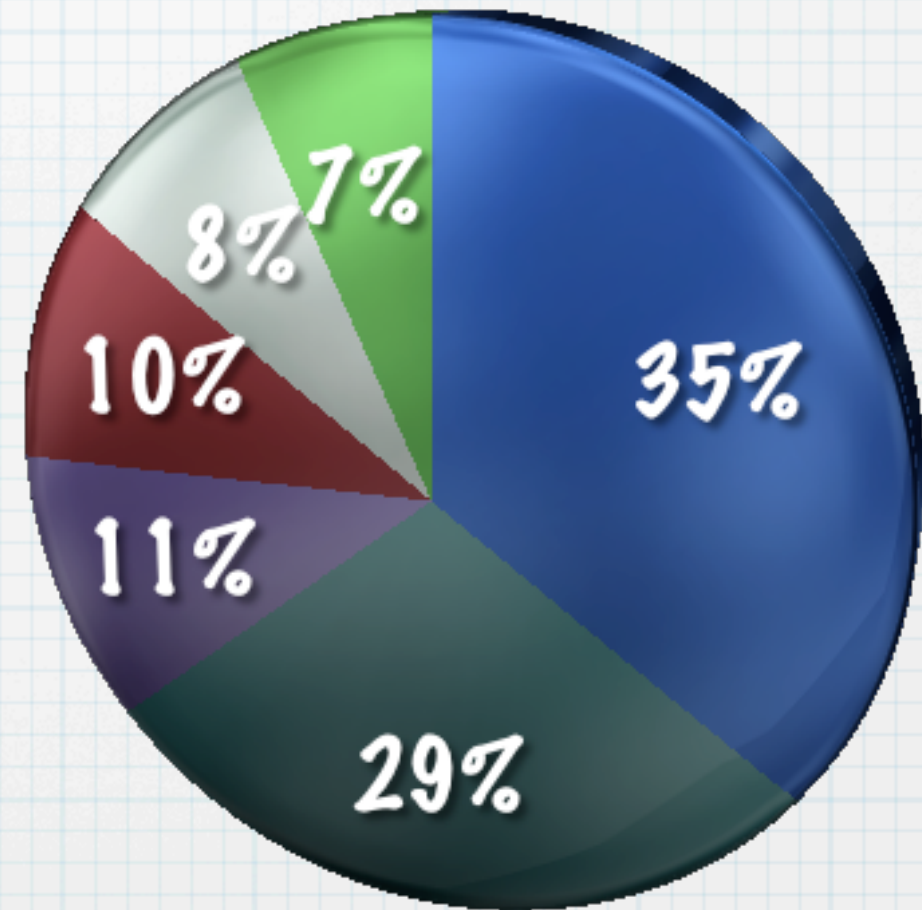
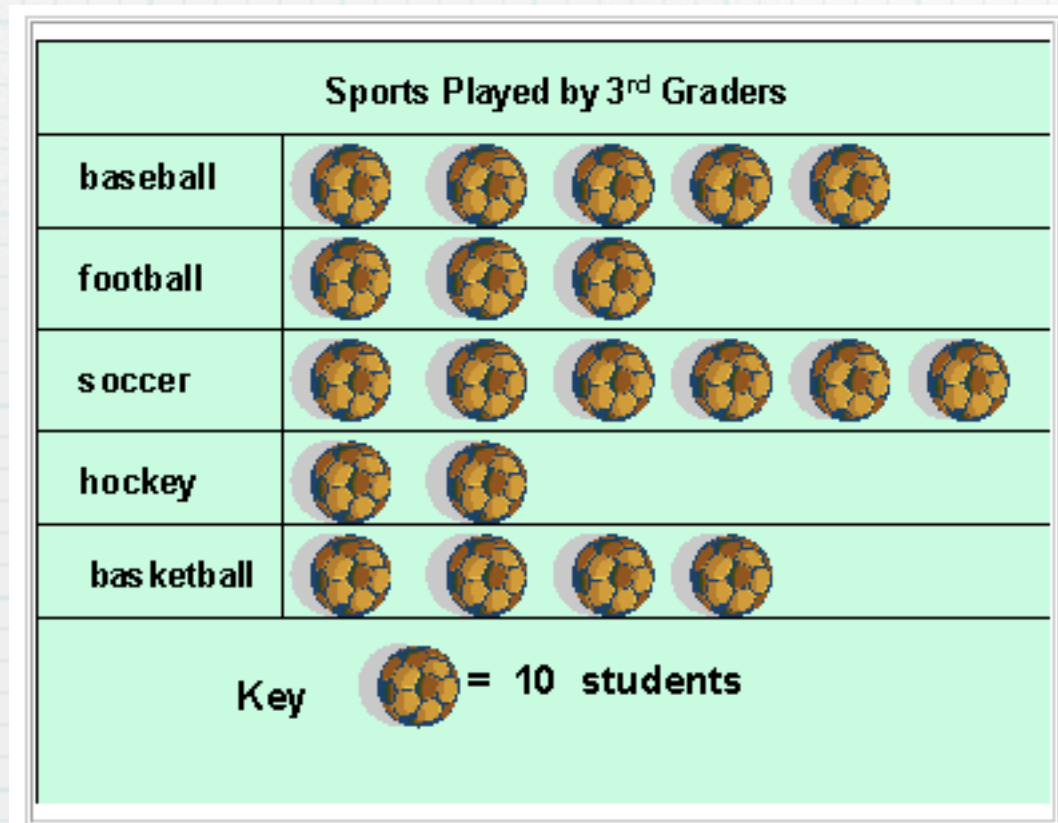


Is there a place  
to easily  
make these?

# Tables, Bar Graph & Line Graph in Pages



# Pictographs and Circle Graphs



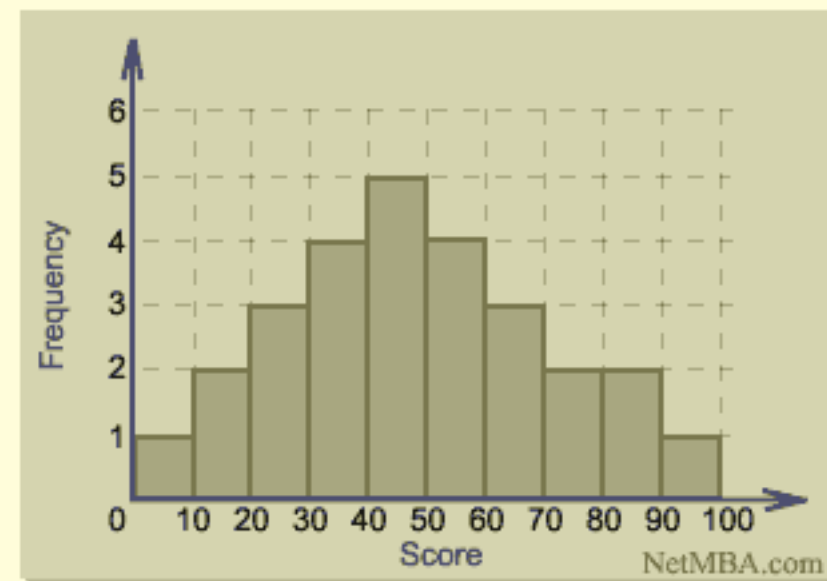


# Histograms

**Frequency Table**

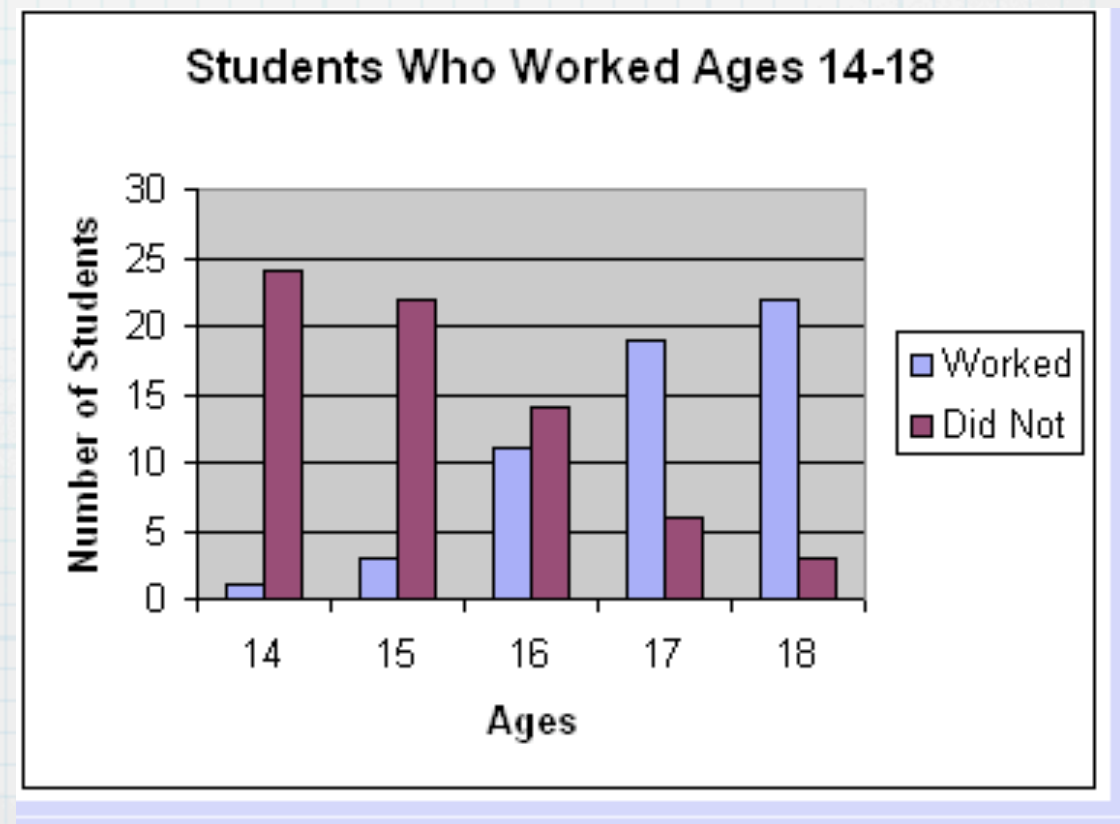
| Group   | Count |
|---------|-------|
| 0 - 9   | 1     |
| 10 - 19 | 2     |
| 20 - 29 | 3     |
| 30 - 39 | 4     |
| 40 - 49 | 5     |
| 50 - 59 | 4     |
| 60 - 69 | 3     |
| 70 - 79 | 2     |
| 80 - 89 | 2     |
| 90 - 99 | 1     |

**Histogram**

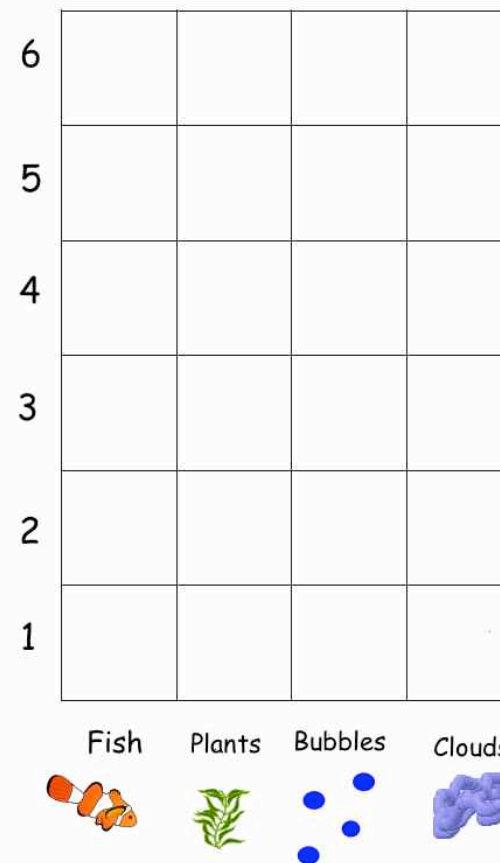
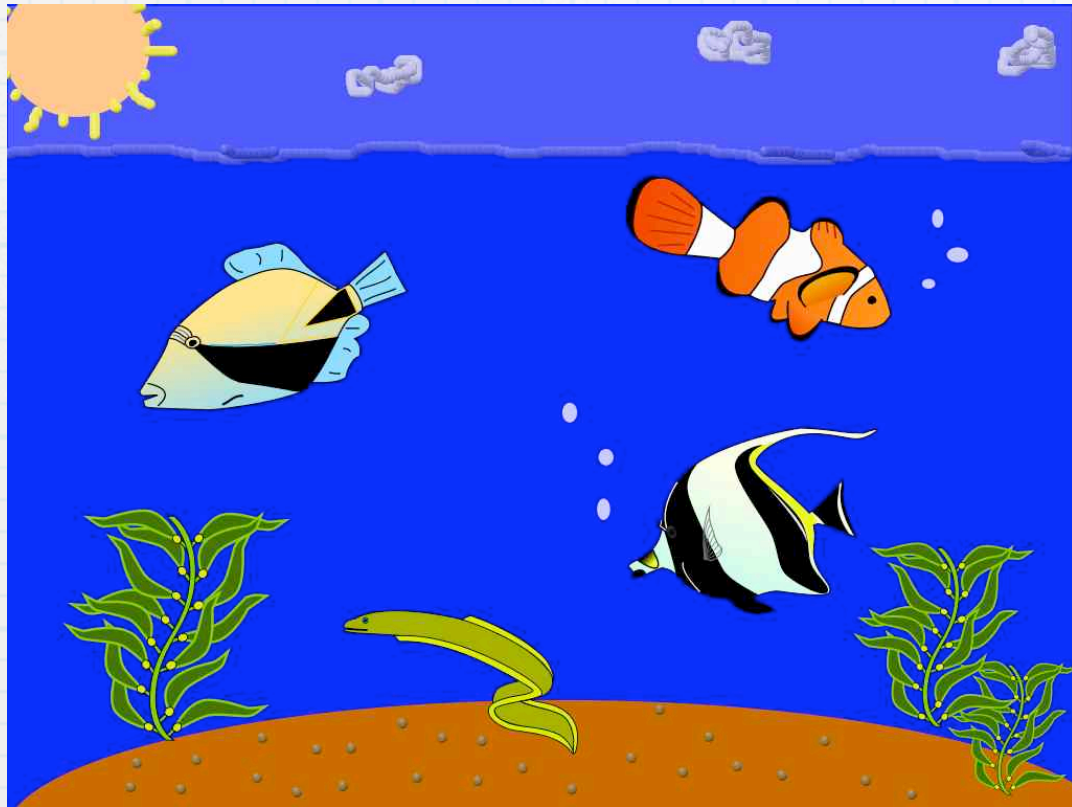


# Stem-and-leaf plot and Double Bar

| Title |         |
|-------|---------|
| Stem  | Leaf    |
| 0     | 1 3 6   |
| 1     | 2 8     |
| 2     | 3 5 6 7 |
| 3     | 0 0 9   |



# Pixie Activities and Templates



What do we see  
under the sea?

Look at the picture  
and graph the  
information.



# Kidspiration Math View

Untitled

1 **Bar Graphs**

1. Use color tiles to make a bar graph based on the table.  
2. Write two observations about your graph in the green boxes.

**Example**

Try it yourself on the following pages!

| Favorite Color | Number of People |
|----------------|------------------|
| red            | 5                |
| blue           | 3                |
| green          | 5                |
| yellow         | 7                |
| orange         | 2                |
| pink           | 4                |
| purple         | 1                |

**Observation #1:**

The height of the yellow bar is the highest. Yellow was the most popular favorite color.

**Observation #2:**

The red and green bars are equal in height. An equal number of students (five each) chose either red or green.

Untitled

2

1. Use color tiles to make a bar graph based on the table.  
2. Write two observations about your graph in the green boxes.

| Favorite Color | Number of People |
|----------------|------------------|
| yellow         | 3                |
| purple         | 3                |
| blue           | 6                |
| orange         | 4                |
| pink           | 7                |
| green          | 7                |
| red            | 5                |

**Observation #1:**

**Observation #2:**

# Probability

- \* Number of ways a certain event can occur  
Number of ways all events can occur
- \* Vocabulary
  - \* Certain, equally likely, chance, fair game, impossible, likely, possible, predict, random sample sample space, unlikely

- \* Scale



# Primary Skills

- \* Possible
- \* Impossible

# Intermediate Skills

- \* What are chances?

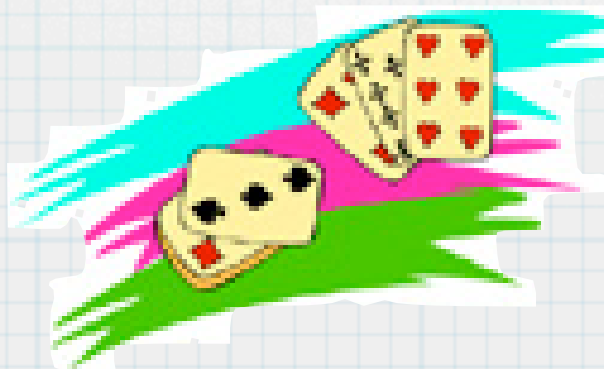
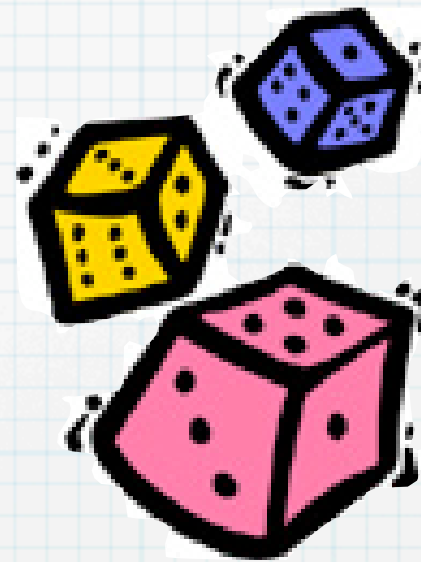


# Intermediate Skills

- \* Understand that all outcomes of an experiment are equally likely
- \* Understand theoretical probability of an event and make predictions
  - \* Outcomes in which the event occurs  
Number of ways all events can occur

# Typically Tools

- \* Spinners
- \* Bags with colored tiles or cubes
- \* Dice
- \* Cards
- \* Coins



# Scratch Tools



K-6 link  
7-12 link



# Your Turn . . .

- \* Using one of the tools that you saw today create a lesson for your classroom.
- \* We will share our ideas with each other near the end of this session.